June 1989

National Semiconductor

54122/DM74122 Retriggerable Resettable Multivibrator

54122/DM74122 Retriggerable Resettable Multivibrator

General Description

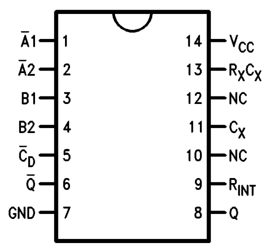
The '122 features positive and negative DC level triggering inputs, complementary outputs, an optional 10 kΩ internal timing resistor and an overriding Direct Clear ($\overline{C}_D$) input. When the circuit is in the quasi-stable (delay) state, another trigger applied to the inputs (per Truth Table) will cause the delay period to start again, without disturbing the outputs. This process can be repeated indefinitely and thus the output pulse period (Q HIGH, $\overline{Q}$ LOW) can be made as long as desired. Alternatively, a delay period can be terminated by a LOW signal applied to $\overline{C}_D$, which also prevents triggering. An internal connection from $\overline{C}_D$ to the input gate makes it possible to trigger the circuit by a positive-going signal on $\overline{C}_D$, as shown in the Truth Table. For timing capacitor values greater than 1000 pF, the output pulse width is defined as follows:

$$t_W = 0.32\ R_X C_X\ (1.0 + 0.7/R_X)$$

Where t_W is in ns, R_X is in kΩ and C_X is in pF.

Connection Diagram

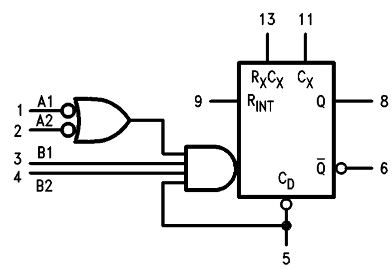
Dual-In-Line Package



TL/F/10212–1

Order Number 54122DMQB, 54122FMQB or DM74122N
See NS Package Number J14A, N14A or W14B

Logic Symbol



TL/F/10212–2

V_{CC} = Pin 14
GND = Pin 7
NC = Pins 10 and 12

Pin Names	Description
$\overline{A}_1$, $\overline{A}_2$	Trigger Inputs (Active Falling Edge)
B_1, B_2	Trigger Inputs (Active Rising Edge)
$\overline{C}_D$	Direct Clear Inputs (Active LOW)
Q, $\overline{Q}$	Outputs

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
54	−55°C to +125°C
DM74	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter	54122			DM74122			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.5	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.8			0.8	V
I_{OH}	High Level Output Current			−0.8			−0.8	mA
I_{OL}	Low Level Output Current			16			16	mA
T_A	Free Air Operating Temperature	−55		125	−55		70	°C

Recommended Operating Conditions $V_{CC} = +5.0V$, $T_A = +25°C$

Symbol	Parameter		Conditions	DM74		Units
				Min	Max	
t_w	Trigger Pulse Width		Over Operating V_{CC} and Temperature Range	40		ns
R_X	External Timing Resistor	XC		5.0	50	kΩ
		XM		5.0	25	
C_X	External Timing Capacitor			No Restrictions		pF

Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −12 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max		2.4			V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, V_{IH} = Min				0.4	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4V	Inputs			40	μA
			Clear			80	
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	Inputs			−1.6	mA
			Clear			−3.2	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)		−10		−40	mA
I_{CC}	Supply Current	V_{CC} = Max				28	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

$V_{CC} = +5.0V$, $T_A = +25°C$ (See Section 3 for waveforms and load configurations)

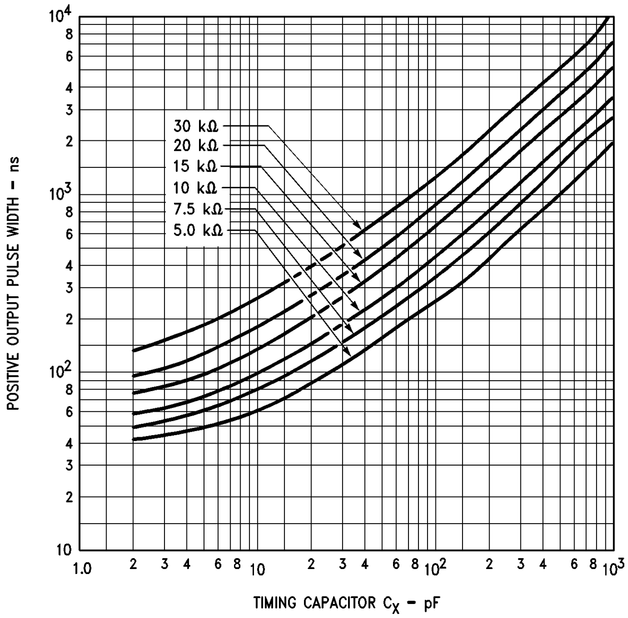
Symbol	Parameter	Conditions	54/74 $C_L = 15\ pF$ $R_L = 400\Omega$ Min	Max	Units
t_{PLH}	Propagation Delay B to Q	$C_X = 0\ pF$, $R_X = 5\ k\Omega$ *Figure 3-1, Figure a*		28	ns
t_{PLH}	Propagation Delay $\overline{A}$ to Q			33	ns
t_{PLH}	Propagation Delay B to $\overline{Q}$			36	ns
t_{PHL}	Propagation Delay $\overline{A}$ to $\overline{Q}$			40	ns
t_{PLH}	Propagation Delay $\overline{C}_D$ to $\overline{Q}$	$C_X = 0\ pF$, $R_X = 5\ k\Omega$ *Figure 3-1, Figure 3-10*		40	ns
t_{PHL}	Propagation Delay $\overline{C}_D$ to Q			27	ns
$t_{w(out)}$	Pulse Width at Q with Zero Timing Capacitor	$C_X = 0\ pF$, $R_X = 5\ k\Omega$ *Figure 3-1, Figure a*		65	ns
$t_{w(out)}$	Pulse Width with External Timing Components	$C_X = 1000\ pF$, $R_X = 10\ k\Omega$ *Figure 3-1, Figure a*	3.08	3.76	μs

Triggering Truth Table

Inputs* $\overline{C}_D$	$\overline{A}_1$	$\overline{A}_2$	B_1	B_2	Response
L	X	X	X	X	No Trigger
X	↓	L	X	X	No Trigger
X	↓	X	L	X	No Trigger
H	↓	H	H	H	Trigger
X	X	X	↑	L	No Trigger
X	H	H	↑	X	No Trigger
H	L	X	↑	H	Trigger
↑	L	X	H	H	Trigger

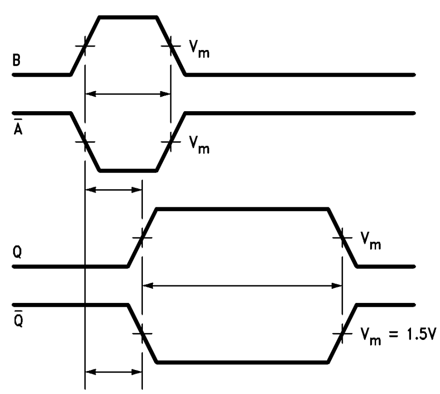
H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
*Input pins 1 and 2 are logically interchangeable, as are input pins 3 and 4.

Pulse Width vs R_X and C_X



TL/F/10212–3

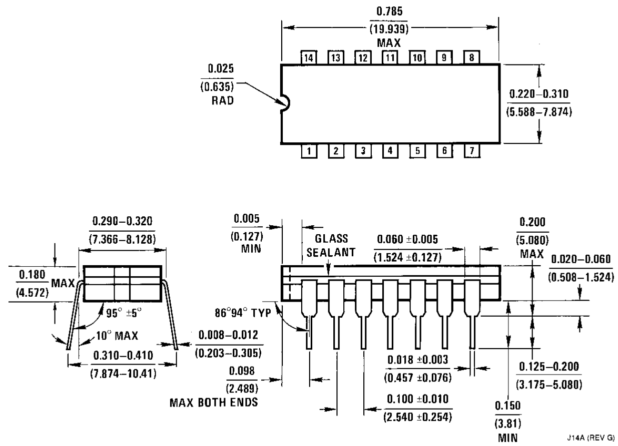
Timing Capacitor C_X–pF



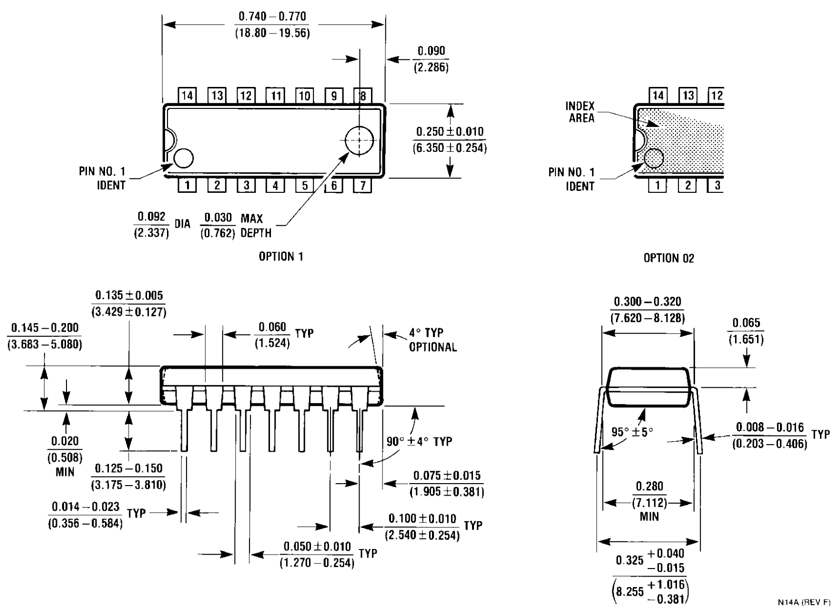
TL/F/10212–4

FIGURE A

Physical Dimensions inches (millimeters)

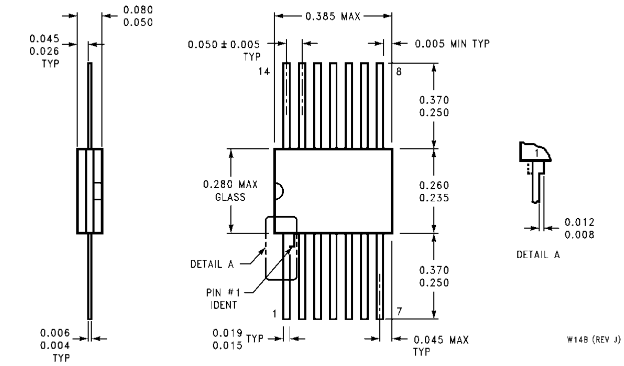


14-Lead Ceramic Dual-In-Line Package (J)
Order Number 54122DMQB
NS Package Number J14A



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74122N
NS Package Number N14A

Physical Dimensions inches (millimeters) (Continued)



14-Lead Ceramic Flat Package (W)
Order Number 54122FMQB
NS Package Number W14B

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408